Claims

1. A conductive polyaniline composition comprising:

(a) a protonated substituted or unsubstituted polyaniline complex, and

(b) a compound having a phenolic hydroxyl group,

(a) and (b) being dissolved in an organic solvent substantially immiscible with water.

2. The conductive polyaniline composition according to claim 1, wherein the substituted or unsubstituted polyaniline is a high-molecular weight component having a weight average molecular weight of 100,000 g/mol or more.

3. The conductive polyaniline composition according to claim 1, wherein the molar concentration of the compound (b) having a phenolic hydroxyl group in the total solution of the composition is 0.01 mol/l to 5 mol/l.

4. The conductive polyaniline composition according to claim 1, wherein the concentration of the protonated substituted or unsubstituted polyaniline complex (a) relative to the organic solvent is 0.01 to 300 g/l.

5. The conductive polyaniline composition according to claim 1, wherein the content of a substituted or unsubstituted polyaniline relative to the protonated

substituted or unsubstituted polyaniline complex (a) is 20 wt% to 70 wt%.

6. The conductive polyaniline composition according to claim 1, wherein the protonated substituted or unsubstituted polyaniline complex (a) is a substituted or unsubstituted polyaniline protonated by an organic protonic acid or a salt thereof represented by the following formula (I),

$$M(XARn)m \qquad (I)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

A is a hydrocarbon group which may have a substituent;

R is independently $-R^1$, $-OR^1$, $-COR^1$, $-COOR^1$, $-CO(COR^1)$, or $-CO(COOR^1)$ (wherein R^1 is a hydrocarbon group with 4 or more carbon atoms which may have a substituent, silyl group, alkylsilyl group, $-(R^2O)x-R^3$, or $-(OSiR^3_2)x-OR^3$ (wherein R^2 is an alkylene group, R^3 is a hydrocarbon group (R^3s may be the same or different), and x is an integer of 1 or more));

n is an integer of 2 or more; and

m is a valence of M.

7. The conductive polyaniline composition according to claim 6, wherein the organic protonic acid or the salt thereof represented by the formula (I) is a compound represented by the following formula (II),

$$M(XCR^4(CR^5_2COOR^6)COOR^7)_p \qquad (II)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

R^4 and R^5 are independently a hydrogen atom, hydrocarbon group, or $R^8{}_3Si-$ (wherein R^8 is a hydrocarbon group (three R^8s may be the same or different));

R^6 and R^7 are independently a hydrocarbon group or $-(R^9O)_q-R^{10}$ (wherein R^9 is a hydrocarbon group or silylene group, R^{10} is a hydrogen atom, hydrocarbon group, or $R^{11}{}_3Si-$ (wherein R^{11} is a hydrocarbon group (three R^{11}s may be the same or different)), and q is an integer of 1 or more); and

p is a valence of M.

8. The conductive polyaniline composition according to claim 7, wherein the organic protonic acid or the salt thereof represented by the formula (II) is a sulfosuccinate derivative represented by the following formula (III),

$$M(O_3SCH(CH_2COOR^{12})COOR^{13})_m \qquad (III)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

R^{12} and R^{13} are independently a hydrocarbon group or $-(R^{14}O)_r-R^{15}$ (wherein R^{14} is a hydrocarbon group or silylene group, R^{15} is a hydrogen atom, hydrocarbon group, or $R^{16}{}_3Si-$ (wherein R^{16} is a hydrocarbon group (three R^{16}s may be the same or different)), and r is an integer of 1 or more); and

m is a valence of M.

9. The conductive polyaniline composition according to claim 6, wherein the protonated substituted or unsubstituted polyaniline complex (a) is obtained by chemical-oxidation polymerizing a substituted or unsubstituted aniline which contains the protonic acid or salt thereof represented by the formula (I).

10. A method for producing a protonated substituted or unsubstituted polyaniline, comprising chemical-oxidation polymerizing a substituted or unsubstituted aniline in a two-phase system of an aqueous solution and an organic solvent substantially immiscible with water to produce a protonated substituted or unsubstituted polyaniline complex soluble in the organic solvent substantially immiscible with water, the system containing an organic protonic acid or a salt thereof represented by the following formula (I),

$$M(XARn)m \qquad (I)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

A is a hydrocarbon group which may have a substituent;

R is independently $-R^1$, $-OR^1$, $-COR^1$, $-COOR^1$, $-CO(COR^1)$, or $-CO(COOR^1)$ (wherein R^1 is a hydrocarbon group with 4 or more carbon atoms which may have a substituent, silyl group, alkylsilyl group, $-(R^2O)x-R^3$, or $-(OSiR^3_2)x-OR^3$ (wherein R^2 is an alkylene group, R^3 is a hydrocarbon group (R^3s may be

the same or different), and x is an integer of 1 or more);

n is an integer of 2 or more; and

m is a valence of M.

11. The method according to claim 10, wherein the organic protonic acid or the salt thereof represented by the formula (I) is a compound represented by the following formula (II),

$$M(XCR^4(CR^5_2COOR^6)COOR^7)_p \qquad (II)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

R^4 and R^5 are independently a hydrogen atom, hydrocarbon group, or R^8_3Si- (wherein R^8 is a hydrocarbon group (three R^8s may be the same or different));

R^6 and R^7 are independently a hydrocarbon group or $-(R^9O)_q-R^{10}$ (wherein R^9 is a hydrocarbon group or silylene group, R^{10} is a hydrogen atom, hydrocarbon group, or R^{11}_3Si- (wherein R^{11} is a hydrocarbon group (three R^{11}s may be the same or different)), and q is an integer of 1 or more); and

p is a valence of M.

12. The method according to claim 11, wherein the organic protonic acid or the salt thereof represented by the formula (II) is a sulfosuccinate derivative represented by the following formula (III),

$$M(O_3SCH(CH_2COOR^{12})COOR^{13})_m \qquad (III)$$

wherein M is a hydrogen atom, or an organic or inorganic free

radical;

R^{12} and R^{13} are independently a hydrocarbon group or $-(R^{14}O)_r-R^{15}$ (wherein R^{14} is a hydrocarbon group or silylene group, R^{15} is a hydrogen atom, hydrocarbon group, or $R^{16}{}_3Si-$ (wherein R^{16} is a hydrocarbon group (three R^{16}s may be the same or different)), and r is an integer of 1 or more); and m is a valence of M.

13. The conductive polyaniline composition according to claim 1, wherein the protonated substituted or unsubstituted polyaniline complex (a) is obtained by the method of claim 10.

14. The conductive polyaniline composition according to claim 1, wherein the compound (b) having a phenolic hydroxyl group is selected from the group consisting of phenol, o-, m-, or p-cresol, catechol, resorcinol, chlorophenol, salicylic acid, hydroxybenzoic acid, hydroxynaphthalene, phenol resins, polyphenol, and poly(hydroxystyrene).

15. The conductive polyaniline composition according to claim 1, wherein the organic solvent substantially immiscible with water is selected from the group consisting of hydrocarbon solvents such as benzene, toluene, xylene, ethylbenzene, and tetralin; halogen-containing solvents such as methylene chloride, chloroform, carbon tetrachloride, dichloroethane, trichloroethane, and

tetrachloroethane; and ester solvents such as ethyl acetate.

16. A method for producing a conductive polyaniline composition comprising the steps of:

(i) chemical-oxidation polymerizing a substituted or unsubstituted aniline in an organic solvent substantially immiscible with water in the presence of an organic protonic acid or a salt thereof represented by the following formula (I) to produce a protonated substituted or unsubstituted polyaniline complex (a) soluble in the organic solvent,

$$M(XARn)m \qquad (I)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

A is a hydrocarbon group which may have a substituent;

R is independently $-R^1$, $-OR^1$, $-COR^1$, $-COOR^1$, $-CO(COR^1)$, or $-CO(COOR^1)$ (wherein R^1 is a hydrocarbon group with 4 or more carbon atoms which may have a substituent, silyl group, alkylsilyl group, $-(R^2O)_x-R^3$, or $-(OSiR^3_2)_x-OR^3$ (wherein R^2 is an alkylene group, R^3 is a hydrocarbon group (R^3s may be the same or different), and x is an integer of 1 or more);

n is an integer of 2 or more; and

m is a valence of M: and

(ii) adding a compound (b) having a phenolic hydroxyl group into the protonated substituted or unsubstituted polyaniline complex (a) dissolved in the organic solvent substantially immiscible with water.

17. The method according to claim 16, wherein the organic protonic acid or the salt thereof represented by the formula (I) is an organic protonic acid or the salt thereof represented by the following formula (II),

$$M(XCR^4(CR^5{}_2COOR^6)COOR^7)_p \qquad (II)$$

wherein M is a hydrogen atom, or an organic or inorganic free radical;

X is an acidic group;

R^4 and R^5 are independently a hydrogen atom, hydrocarbon group, or $R^8{}_3Si-$ (wherein R^8 is a hydrocarbon group (three R^8s may be the same or different));

R^6 and R^7 are independently a hydrocarbon group or $-(R^9O)_q-R^{10}$ (wherein R^9 is a hydrocarbon group or silylene group, R^{10} is a hydrogen atom, hydrocarbon group, or $R^{11}{}_3Si-$ (wherein R^{11} is a hydrocarbon group (three R^{11}s may be the same or different)), and q is an integer of 1 or more); and

p is a valence of M.

18. A conductive molded article obtainable by forming the conductive polyaniline composition according to any one of claims 1 to 9 and 13 to 15.

19. The conductive molded article according to claim 18 whose inherent conductivity is at least 50 S/cm.

20. A surface-electric-conductive product obtainable by

applying the conductive polyaniline composition according to any one of claims 1 to 9 and 13 to 15, to a substrate.

21. The surface-electric-conductive product according to claim 20 whose specific surface resistance is at most 10^5 Ω.

22. The transparent surface-electric-conductive product according to claim 21 whose light transmission is 70% or more at 450 nm.

23. A method for producing a surface-electric-conductive product comprising:

applying the conductive polyaniline composition according to any one of claims 1 to 9 and 13 to 15, to a substrate, and

forming the applied substrate.